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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/933,304	08/20/2001	Peter Lahnor	6521/83562	5680

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EXAMINER

VINH, LAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 12/09/2002

8

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/933,304

Applicant(s)

LAHNOR ET AL

Examiner

Lan Vinh

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 August 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/933,304.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Information Disclosure Statement

1. The Information disclosure Statement (IDS) filed on 1/28/2002 has been considered.

The PTO 1499 form is enclosed.

Oath/Declaration

2. The examiner notes that although the applicants claim foreign priority benefit under Title 35, United State code, & 119 based on document number 10042932.7, the Priority Claimed box is not marked. Correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1, 4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In lines 8-9 of claim 1, it is not clear which dielectric and liner the term " dielectric and liner" refers to. The examiner suggests inserting the language of--the said-- between the term "between" and "dielectric" and between "and" and "liner" in order to clarify the claim language.

Claim 4 recites the limitation "the reaching of" in claim 1. There is insufficient antecedent basis for this limitation in the claim.

Art Unit: 1765

5. For the purpose of examination, the claim language of "the liner" is defined as generally composed of a relatively hard material such as titanium in page 5 of the specification. The claim language of "an auxiliary layer" is defined as a carbon polymer layer having a thickness of 20-100 nm or a perforated layer in page 3 and 5 of the specification.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

7. Claims 1, 2, 6 are rejected under 35 U.S.C. 102(e) as being anticipated by Gupta et al (US 6,274,499).

Gupta discloses a method to avoid copper contamination during copper/metal dry etching and CMP (Chemical mechanical polishing) in which a barrier metal layer (titanium) 22/liner is deposited over the whole surface/area on a patterned dielectric

layer 14 (col 3, lines 26-53; fig. 7), a metalization layer 26 of copper is deposited over the whole surface/area on the metal layer/liner 22 (col 4, lines 31-33), the copper/metalization layer 26 and the liner 22 are removed in regions by Chemical Mechanical Polishing (CMP) process, the CMP process stops on the dielectric layer 14 (col 4, lines 35-48; fig. 9 shows the CMP process stops on the dielectric layer 14), a perforated hydrocarbon polymer layer 16 having a thickness of 500 angstroms (50 nm) is deposited between the dielectric layer 14 and barrier metal/liner layer 22 in the regions covering the patterned portions of the dielectric layer 14, the hydrocarbon polymer layer 16 is polished away by CMP (col 3, lines 29-35, col 4, lines 38-40; fig. 7 shows that layer 16 is perforated and covering the patterned portions of the dielectric layer 14) which reads on at least in the regions surrounding the patterned portions on the dielectric, an auxiliary layer which can be easily be removed by the CMP process is fashioned between the dielectric and liner.

Regarding claim 2, Gupta discloses that perforated hydrocarbon polymer layer 16 has a thickness of between about 500 and 3000 angstrom (col 3, lines 29-31), the thickness of 500 angstrom (50 nm) is encompassed by the claimed range of 20-100 nm.

The limitation of the auxiliary layer is composed of carbon polymer, as recited in claim 6, has been discussed above.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Li et al (US 6,331,479)

Gupta's method has been described above in paragraph 7. Regarding claim 3, Gupta discloses performing a plasma/dry etching step (col 4, lines 65-67). Unlike the instant claim invention as per claim 3, Gupta does not disclose using the layer 16/auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

However, Li discloses a method for forming copper damascene interconnect comprises the step of using the perforated layer 104, deposited between a liner 114 and dielectric layer 100, partly as a hard mask for the patterning preceding the dry etching (col 5, lines 36-67) which reads on using an auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

Since both Gupta and Li are concerned with method of patterning a dielectric layer before dry etching/plasma etching, one skilled in the art would have found it obvious to employ Gupta's layer 16/auxiliary layer as a hard mask for the patterning preceding the dry etching as taught by Li because according to Li the presence of layer 104/hard mask layer protects the dielectric layer from damage due to plasma (col 6, lines 7-9)

10. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Holland et al (US 6,261,158)

Gupta's method has been described above in paragraph 7. Regarding claim 4, although Gupta discloses performing the polishing process by CMP to reach the layer 16/auxiliary layer. Gupta does not disclose the reaching of the auxiliary layer is detected by an etching stop detection during the CMP process.

However, Holland discloses a multi step CMP method to polish metal layer comprises the step of detecting the reaching of a layer 25 by an etching stop detection signal during the polishing step (col 6, lines 6-9)

Since Gupta is concerned with the step of polishing metal (copper) to reach the layer 16/auxiliary layer, one skilled in the art would have found it obvious to modify Gupta's method by detecting the reaching of layer 16 by an etching stop detection signal during the polishing step in view of Holland's teaching because Holland states that because the metal polishing is stopped when the layer is detected, there is typically some metal recesses, but the amount of metal recesses is less than in the conventional method (col 6, lines 14-17)

11. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Chen et al (US 6,025,273)

Gupta's method has been described above in paragraph 7. Unlike the instant claimed invention as per claim 5, Gupta does not disclose performing an additional wet-chemical cleaning step at the end of the etching.

Art Unit: 1765

However, Chen discloses a method for etching small contact hole comprises the step of performing an additional wet -chemical cleaning step at the end of the etching (col 5, lines 12-33)

Since Gupta is concerned with the step of etching the hydrocarbon polymer layer 16 on the dielectric layer 14 , one skilled in the art would have found it obvious to modify Gupta's method by adding the step of wet -chemical cleaning step at the end of the etching as per Chen because Chen teaches that the wet etch /cleaning removes any remaining carbon on the surface of the oxide(dielectric) layer (col 5, lines 29-30)

12. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Schwalke et al (US 5,726,094)

Gupta's method has been described above in paragraph 7. Unlike the instant claimed invention as per claim 7, Gupta does not disclose using the hydrocarbon polymer layer 16/ auxiliary layer in conjunction with a CARL resist as bottom resist

However, Schwalke discloses a process for producing a diffusion region adjacent to a recess in a substrate comprises the step of using a layer 6 deposited between a dielectric layer 43 and liner 12 in conjunction with a CARL resist layer 14 as bottom resist (col 4, lines 26-45; col 5, lines 34-41 and fig. 12) which reads on using an auxiliary layer in conjunction with a CARL resist as bottom resist

Since Gupta discloses using the perforated hydrocarbon polymer layer 16/auxiliary layer as a cap layer to prevent copper contamination/diffusion barrier layer (see abstract), one skilled in the art would have found it obvious to modify Gupta method by

Art Unit: 1765

using the auxiliary layer in conjunction with a CARL resist as bottom resist as per Schwalke because according to Schwalke in order to structure the diffusion layer, a bottom resist layer is preferable applied to the diffusion layer (col 3, lines 10-18)

Conclusion

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.



LV

December 4, 2002